MULTIMEDIA UNIVERSITY

STUDENT ID NO

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FINAL EXAMINATION

TRIMESTER 2, 2017/2018

TCP2651 – CONCEPTS OF PROGRAMMING LANGUAGES
TCP2411 –PROGRAMMING LANGUAGE CONCEPTS

(All sections)

5 MARCH 2018
2.30 p.m - 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 4 questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks are given in the Question paper.

3. Please print all your answers in the Answer Booklet provided.

Question 1 (25m)

a) What are the inputs and outputs of the following components of a compiler?

I. Lexical analyzer
II. Syntax analyzer
III. Code generator

[6m]

b) Many languages distinguish between uppercase and lowercase letters in user-defined names. What are the pros and cons of this design decision?

[6m]

c) The following is an example class header statement:

public class A extends B implements C, D

where "public" is a modifier and "A", "B", "C", and "D" are identifiers.

Write EBNF descriptions for a *Java* class definition header statement. Assume the definition of non-terminal <id> is given.

[13m]

Continued...

Question 2 (25m)

a) Prove that the following grammar is ambiguous:

<S> -> <A>
<A> -> <A> + <A> | <id>
<id> -> a | b | c

[10m]

b) Convert the following recursive BNF grammar to EBNF without recursion:

<assign> -> <id> = <expr>
<expr> -> <id> + <expr>
| <id> * <expr>
| (<expr>)
| <id>

[6m]

c) Define the rule for binary number in both BNF and EBNF.

[9m]

Continued...

Question 3 (25m)

a) Some programming languages are typeless. What are the advantages and disadvantages of having no types in a language?

[4m]

b) Given the following grammar and the right sentential form, draw a parse tree for aAccebbc.

S-> AbB | bAc
A -> Ab | aBB
B-> Ac | cBb | c

[9m]

c) Consider the following skeletal C-like program.

```
void fun1(void) {
        int b, c, d;
        // call another function
}
void fun2(void) {
        int c, d, e;
        // call another function
}
void fun3(void) {
        int d, e, f;
        // call another function
}
void main () {
        int a, b, c;
        // call another function
}
```

Given the following calling sequences and assuming that dynamic scoping is used, what variables are visible during execution of the last function called? Include with each visible variable the name of the function in which it was defined.

I. main calls fun1; fun1 calls fun2; fun2 calls fun3.
II. main calls fun1; fun1 calls fun3.
III. main calls fun2; fun2 calls fun3; fun3 calls fun1.

[12m]

Continued...

Question 4 (25m)

a) What are the pros and cons of using unique closing reserved words on compound statements?

[6m]

b) Assume the following rules of associativity and precedence for expressions:

Precedence	Highest	***, / , not***
		+, - , & , mod
		-(unary)
		=, /=, <, <=, >=, >
		and
	Lowest	**or, xor**
Associativity	Left to right	

Show the order of evaluation of the following expressions by parenthesizing all subexpressions and placing a superscript on the right parenthesis to indicate order. For example, for the expression

a + b * c + d

the order of evaluation would be represented as

$((a+(b*c)^1)^2+d)^3$

I. a * b – 1 + c

II. a * (b-1) / c **mod** d

III. (a – b) / c & (d * e / a – 3)

[9m]

c) Given the program below, write a semantically equivalent program that avoids using goto.

```
for (i=1; i<=n; i++) {
        for( j=1; j<=n; j++)
                if(x[i][j] != 0)
                        goto reject;
        print ("First all-zero row is:", i);
        break;
        reject:
}
```

[10m]

THE END